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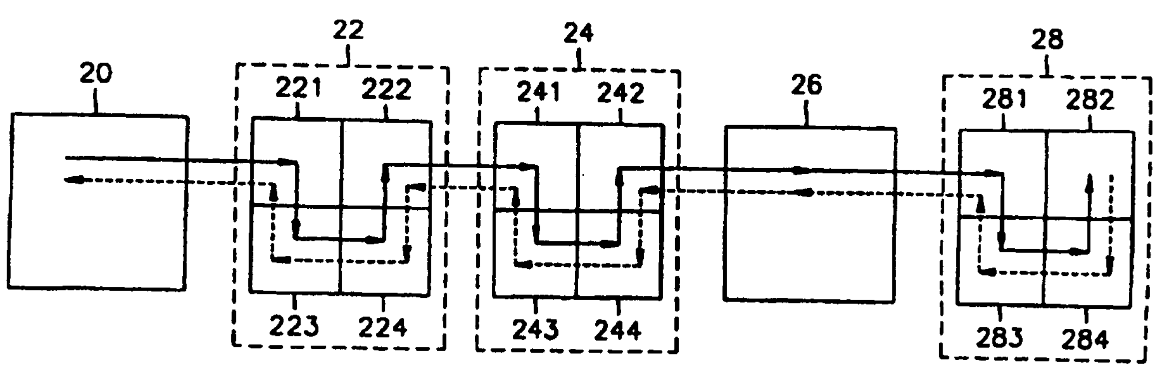
(54) Abstract Title
Motion vector prediction method

(57) In a motion vector prediction method based on the image signal compression method of the MPEG-4 or H.263 standard, the motion vector prediction is performed with continuity and correlation among the motion vectors, so that two-way decoding is possible during transmission of blocks with a predetermined packet, resulting in better error resilient characteristics. Motion vectors of macro blocks are calculated, and motion vectors of macro blocks each having one motion vector are predicted while moving to another macro block from left to right, and motion vectors of macro blocks each having four motion vectors are continuously predicted in a predetermined sequence to have correlation in prediction of the four motion vectors.

FIG. 2



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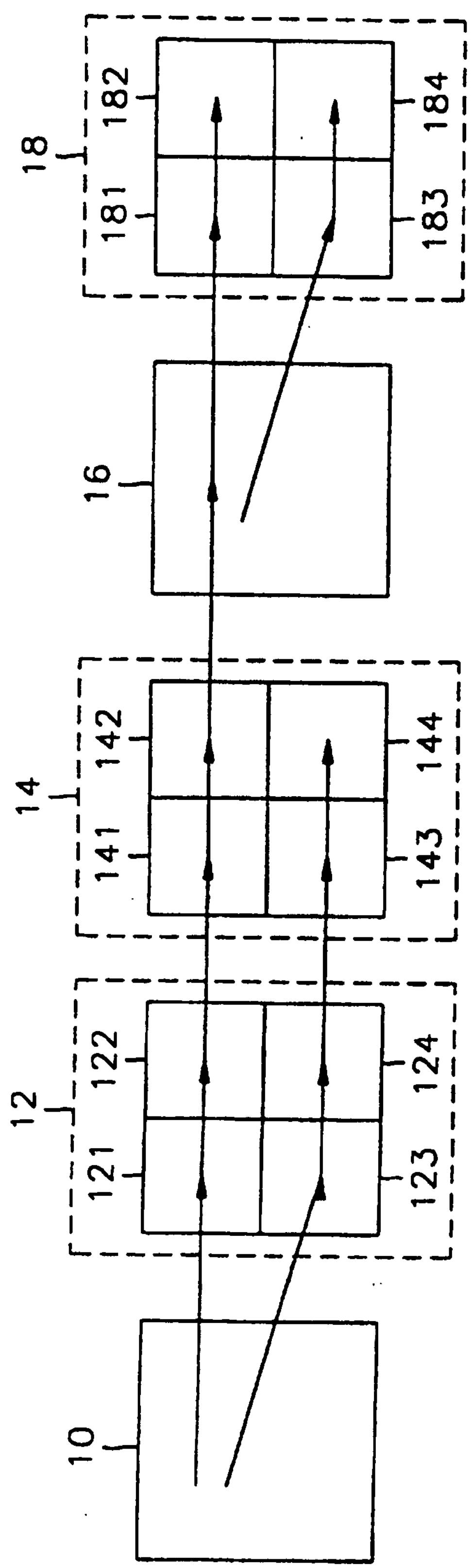

FIG. 1 (PRIOR ART)

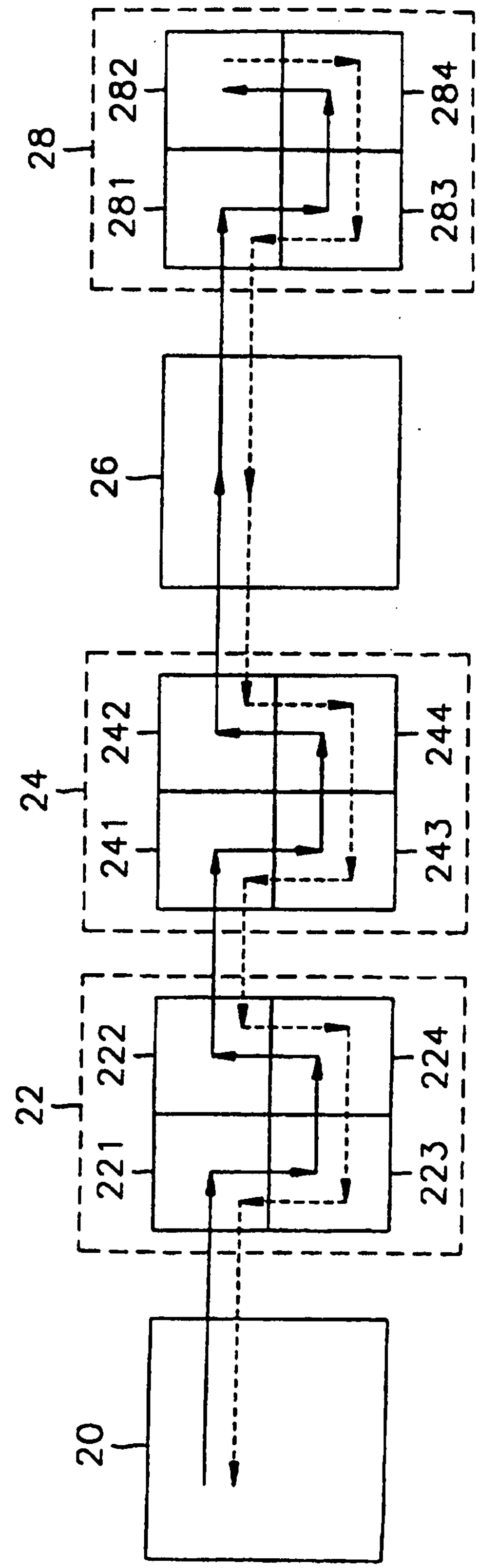

FIG. 2

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MOTION VECTOR PREDICTION METHOD

The present invention relates to a motion vector prediction method, and more particularly, to a motion vector prediction method in an error resilient mode.

In general, redundancy of a moving picture must be effectively eliminated so as to compress the moving image. The moving picture experts group (MPEG) adopts a motion prediction method. According to the motion prediction method, the current frame is divided into a plurality of macro blocks, and then each macro block (reference block) is compared with each macro block (matching block) of a previous frame within a given area, to calculate the difference therebetween. Then, the macro blocks having the lowest difference are selected to calculate motion vectors representing the difference in positions between the reference and matching blocks. In the motion vector prediction, the difference between a predicted motion vector and actual motion vector of the current block is encoded, in place of encoding the motion vector itself of the current block, thereby improving coding efficiency.

Figure 1 is a diagram illustrating a conventional motion prediction method and coding sequence adopted in the MPEG-4 and the H.263 standards.

In Figure 1, reference numerals 10 through 18 represent macro blocks each consisting of 16 pixels × 16 pixels, reference numerals 10 and 16 are macro blocks each to have one motion vector, and reference numerals 12, 14 and 18 represents macro blocks each to have four motion vectors. The macro blocks 12, 14 and 18 are divided into four subblocks with 8 pixels × 8 pixels, based on the

MPEG-4 or the H.263 standard, and those four motion vectors are calculated from the four subblocks.

Here, prior to transmission of the difference among each motion vector, motion vector prediction is separately performed in upper subblocks 121, 122, 141 and 142 and lower subblocks 123, 124, 143 and 144 of the macro blocks 12 and 14 from the macro block 10 in a solid arrow direction. Here, motion vector is predicted from motion vectors calculated in the upper subblock 142, the macro blocks 16 and the subblocks 181 through 184 of the macro block 18 with correlation. However, the motion vector prediction is not performed between the motion vectors of the subblock 144 and the macro block 16, and the motion vector prediction continues toward the lower subblocks 183 and 184 from the macro block 16.

Thus, if an error occurs, the motion vector can be decoded from the macro block 16 toward the upper subblock 142 in a backward direction. However, if an error occurs in the lower subblock 123 of the macro block 12, it is not possible to reversely calculate the motion vectors of the subblock 144 and its left subblock 143 from the macro block 16 using a motion vector prediction code.

As a result, it is not possible to decode the blocks following the erroneous block, thereby increasing loss in motion vector value. Although an error concealment is adopted, there is a problem in loss of information.

It is an aim of the present invention to provide a motion vector prediction method capable of restoring a motion vector lost after an error occurs, through backward decoding. It is a further aim to provide such a motion

vector prediction method for use even when information is lost during transmission due to the error.

According to the present invention there is provided a motion vector prediction method capable of decoding backwards, comprising the steps of: (a) calculating motion vectors of macro blocks; and (b) predicting motion vectors of macro blocks each having one motion vector while moving to another macro block, preferably from left to right, and motion vectors of macro blocks each having four motion vectors continuously in a predetermined sequence to have correlation in prediction of the four motion vectors.

Preferably, in the step (b) when one macro block has one motion vector, the motion vector prediction of the current block is performed using the motion vector of the macro block on the left of the current block or the previous coded macro block.

Preferably, in the step (b) when one macro block has four motion vectors, the motion vectors are continuously predicted from the motion vectors of the upper-left, lower-left, lower-right and upper-right subblocks in sequence.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 is a diagram illustrating a general motion prediction method and coding sequence according to the MPEG-4 and the H.263 standard; and

Figure 2 is a diagram illustrating a motion vector prediction method which allows a backward decoding in an error resilient mode, and coding and decoding sequences according to an embodiment of the present invention.

Referring to Figure 2, a motion vector prediction method capable of decoding backwards in an error resilient mode, and coding and decoding sequences according to a preferred embodiment of the present invention are illustrated. In Figure 2 there are shown macro blocks which are generally the same as those described above in relation to Figure 1. Here, reference numerals 20 and 26 represent macro blocks each having one motion vector, and reference numerals 22, 24 and 28 represents macro blocks each having four motion vectors. The macro blocks 22, 24 and 28 are divided into four subblocks of 8 pixels × 8 pixels and those four motion vectors are calculated in the four subblocks.

The motion vectors are predicted in a solid arrow direction as shown in Figure 2. That is, the motion vectors are predicted from the macro block 20 toward the macro block 22 having four motion vectors, through subblocks 221, 223, 224 and 222 in sequence, and then through subblocks 241, 243, 244 and 242 of the macro block 24. The prediction of motion vectors continues in the macro blocks 26 and 28 in the direction indicated by solid arrows.

Thus, in case that an error occurs in the subblock 223 and the macro block 28 is the last macro block of the erroneous group of block (GOB) when the difference between motion vectors are transmitted, motion vectors of non-erroneous blocks can be restored by reversely decoding in sequence from the subblock 282 of the macro blocks 28 in

the direction indicated by dashed arrows. This is because the motion vector prediction continues with a correlation among the motion vectors of each block.

As described above, in the preferred motion vector prediction method, which is based on the image signal compression method of the MPEG-4 or H.263 standard, the motion vector prediction is performed with continuity and correlation among the motion vectors, so that two-way decoding is possible during transmission of blocks with a predetermined packet, resulting in better error resilient characteristics.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A motion vector prediction method capable of decoding backwards, comprising the steps of:

(a) calculating motion vectors of macro blocks; and

(b) predicting motion vectors of macro blocks each having one motion vector while moving to another macro block, and motion vectors of macro blocks each having four motion vectors continuously in a predetermined sequence to have correlation in prediction of the four motion vectors.

2 The motion vector prediction method of claim 1, wherein in the step (b), the motion vector prediction is performed moving from left to right.

3. The motion vector prediction method of claim 2, wherein in the step (b) when one macro block has one motion vector, the motion vector prediction of the current block is performed using the motion vector of the macro block on the left of the current block or the previous coded macro block.

4. The motion vector prediction method of claim 3, wherein in the step (b) when one macro block has four motion vectors, the motion vectors are continuously predicted from the motion vectors of the upper-left, lower-left, lower-right and upper-right subblocks in sequence.

5. A motion vector prediction method substantially as hereinbefore described.

6. A motion vector prediction method substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

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Claims searched: 1 to 6

Examiner: John Donaldson
Date of search: 31 March 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H4F(FGM, FHC, FHD, FHHX, FRG, FRP, FRW, FRX)

Int Cl (Ed.6): H04N 5/00, 5/14, 7/00, 7/24, 7/26, 7/30, 7/32, 7/34, 7/36, 7/46, 7/48, 7/50, 7/64, 7/68, 11/00, 11/02, 11/04

Other: Online:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0798929 A2 (NEC), see abstract	-

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
& Member of the same patent family
A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.